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UNIVERSITY OF MINNESOTA
APR 29 1960

PROGRAM NUMBER
THIRTY-SEVENTH ANNUAL MEETING
OF
THE GEORGIA ACADEMY OF SCIENCE
UNIVERSITY OF GEORGIA
ATHENS, GEORGIA
April 22-23, 1960

Local Arrangements Chairman — Dr. Carroll T. Clark
University of Georgia

Georgia Junior Academy of Science Meeting and Annual Science Fair
Athens, Georgia. April 7, 8, 9, 1960

BRING THIS PROGRAM WITH YOU TO THE MEETING

PROGRAM

FRIDAY, APRIL 22, 1960

Morning

8:00-12:00	Registration. In Lobby of New Chemistry Building.
9:00-11:30	Section Meetings. Presentation of Papers and Election of Officers. Auditorium, New Chemistry Building.
11:45-12:45	General Academy Business Meeting. Remarks by the President. Auditorium, New Chemistry Building.

Afternoon

2:00- 3:30	Presentation of Papers of general interest. All sections meeting together.
3:30- 5:00	Section Meetings. Presentation of Papers and Tour of Science Center.

Evening

8:00	Symposium. Auditorium, New Chemistry Building.

Science in Georgia—1960.

Dr. W. B. Baker, Coordinator.

SECTION I

BIOLOGY

FRIDAY, APRIL 22, 1960—9:00 A.M.

Room 231, New Chemistry Building

Dr. E. S. Luttrell, Presiding

Tree Seed Testing at the Regional Seed Laboratory

LEROY JONES, U. S. Forest Service, Macon
(Introduced by W. A. Campbell)

A new, modern tree seed testing laboratory is now located at the Georgia Forestry Center, Macon, Georgia, which is devoted to testing forest tree seed from the eastern United States.

Testing tree seed is important in that it provides data (1) to determine the sowing rate in the nursery, which is important because of the necessity to control density in the nursery in order to produce good quality seedlings; (2) to determine the germinative energy; (3) to determine whether or not certain species need pre-germination treatment; (4) to determine the moisture content, as this is a very critical factor in storage, and (5) for buying and selling based on the germination percent.

Precise data is needed; therefore, it is necessary that all testing be done under controlled conditions including light, temperature, moisture, aeration, diseases, and insects.

Over 2,000 tests are now completed at the laboratory each year. Approximately one-half of the tests are for research purposes. These include studies such as seed storage, testing techniques, breaking of dormancy, and the effects of chemicals on seed.

10 minutes *2 x 2 slides*

Root Development of Ponderosa Pine Seedlings in the Black Hills

DAVID F. VANHAVERBEKE, Southeastern Forest Experiment Station, U. S. Forest Service
(Introduced by W. A. Campbell)

In 1958 a root-development study of ponderosa pine seedlings was conducted in the Black Hills of South Dakato to determine rates of lateral and vertical root penetrations of seedlings throughout the growing season and at two and three years of age. Study plots, kept free of competing vegetation, were established on burns in soils originating from metamorphic and limestone formations. Seedlings were excavated hydraulically, measured, sketched, and photographed at two week intervals from emergence throughout the growing season. Similar studies were made of seedlings sown in 1956 and 1957 in the same soil types but not freed from competition.

First year taproot penetrations of 1958 seedlings averaged about 34 centimeters in both plots. Maximum lateral root penetrations of 1958 seedlings averaged about 17 and 12 centimeters in the metamorphic and limestone plots respectively.

An unidentified fungus, discovered in the limestone plot, reduced taproot penetrations of infected seedlings to about 19 centimeters and greatly reduced the number and length of lateral roots.

First year growth of 1958 seedlings freed of competition far exceeded that of 1956 and 1957 seedlings not free of competition. Growth of 1956 and 1957 seedlings in the metamorphic area, where competition was moderate also far exceeded 1956 seedlings grown in the limestone area where competition was heavy.

10 minutes *2 x 2 slides*

Needle Growth of Pine Reproduction Affected by Size of Forest Overwood Openings

L. W. R. JACKSON, School of Forestry, University of Georgia

In a study of the relation of forest overwood opening size to growth of pine reproduction, additional data were taken on needle growth of shortleaf (*Pinus echinata* Mill) and loblolly pine (*P. taeda* L.) seedlings after 3 growing seasons on the plots. A composite sample of needles was collected from each species in each of the 6 overwood opening diameter classes, which increased by 10-foot intervals from 5 to 55 feet. The various needle characteristics measured were highly correlated with overwood opening diameter and per cent of full sunlight. Loblolly pine needle length increased from 10.7 to 16.5 cm with an increase opening diameter ($r = +.986$) and per cent light ($r = +.939$). Shortleaf needles increased from 6.8 to 10.6 cm with $r = +.985$ for opening diameter and $r = +.924$ for per cent light. The oven-dry weight of loblolly needles increased from 12.0 to 25.0 mg with $r = +.985$ for opening diameter and $r = +.980$ for per ecnt light. Shortleaf needle weight increased from 7.3 to 14.8 mg with $r = +.985$ for opening diameter and $r = +.980$ for per cent light. There was less modification of needle width and thickness with increase in size of overwood opening. For loblolly, the width increased from 0.94 to 1.27 mm, and the thickness increased from 0.47 to 0.68 mm. For short leaf,the width increased from 0.88 to 1.14 mm, and the thickness increased from 0.43 to 0.62 mm.

8 minutes *2 x 2 slides*

Liquidambar Styracifula L. and Certain Coniferous Species Affected by Black Root Rot in Southern Nurseries

SAMUEL J. ROWAN, U. S. Forest Service, Macon

Twenty-three tree species were grown in black root rot infested soil under greenhouse conditions known to be ideal for optimum deisase production. Eleven *Pinus* species were listed as susceptible. *Pinus glabra* Walt. was the only *Pinus* species to be classified as highly resistant. Four species were listed as immune, two were highly resistant, and six species died before completion of the test.

10 minutes *2 x 2 slides*

The Use of Fire to Reduce Forest Litter Accumulations

ROBERT M. ROMANCIER, Macon Research Center, U. S. Forest Service
(Introduced by Ernst V. Brender)

The use of fire has become recognized as a silvicultural tool when applied by trained foresters. Prescribed burning has been used for seedbed preparation, hazard reduction, and disease control, to cite a few examples.

A series of prescribed burns was programmed for a mature loblolly pine stand growing on a flat, poorly drained site in southeastern Virginia. Due to the wet site, normal litter decomposition was greatly retarded. Leaves, pine needles, twigs, and larger pieces of wood remained undecayed on the forest floor, and would act as a deterrent to natural reproduction following a partial or complete stand harvest. Sampling revealed that there were over thirty-six tons of litter per acre, oven dry weight.

Three areas were burned; each received a winter burn and then one, two, and three summer burns, respectively. After the second summer fire, the average litter depth was reduced sixty-three per cent, from 4.8 inches to 1.8 inches, while the shrub height was lowered seventy-nine per cent, from 29 inches to 6 inches. After the third summer fire, the total amount of litter was twenty-two tons per acre, a thirty-nine per cent drop. These prescribed burns, coupled with the disturbance from logging operations, should eliminate the abnormal litter deposit as a limiting factor to natural reproduction.

9 minutes

Variations Between Stocks of the Same Inbred Line of Maize

A. A. FLEMING, G. M. KOZELNICKY, and E. B. BROWNE, Department of Plant Pathology and Plant Breeding, College Experiment Station, University of Georgia

Stocks of six well-established inbred lines of corn were compared to determine if any variations existed between different stocks (Sources) within the same inbred line. Each of the inbreds had been propagated several years in the breeding programs at five or more agricultural experiment stations. Seed were obtained from corn geneticists one year, increased at Athens the second year, and tested at Athens the third year.

Individual plant notes on the replicated trial were taken for characteristics such as silking, pollen shed, leaf position, leaf coloration, plant and ear heights, lodging, and reaction to *Helminthosporium turcicum*.

Significant differences were obtained between certain stocks within the inbreds. Results show that well-established inbred lines of maize may undergo changes after they are distributed from the originating station. As the stocks are maintained by different geneticists in different environments over long periods of time, their divergence may become even greater.

10 minutes *2 x 2 slides*

Cleistogamous and Chasmogamous Seed of Lespedeza Cuneata

ROBERT E. BURNS, Plant Physiologist
Crops Research Division,
Agricultural Research Service,
U. S. Department of Agriculture
Experiment

Lespedeza cuneata is one of the species that produce both cleistogamous and chasmogamous flowers. The feasibility of using this trait as a means of controlling out crossing in this species and also the performance that could be expected from each type of seed were studied.

The proportion of seed of each type could be changed by shading the plants. Shaded plants yielded nearly 100 per cent cleistogamous seed as compared with 60-70 per cent in the controls. Clipping plants during the growing season also increased cleistogamous seed production. Growing plants in the greenhouse in the winter or in controlled chambers with 1200 foot-candles of light at 83° F. almost completely suppressed formation of open flowers, and the plants produced only cleistogamous seed.

The two types of seed can be distinguished in the hull. When the hulls are removed, the seed are identical in appearance. The tannin content is quantitatively and qualitatively identical.

The chasmogamous seed are somewhat heavier and produce larger seedlings. This growth advantage, which can also be noted in the older plants, is probably due at least in part to heterosis.

Plants from chasmogamous seed produce the same proportion of cleistogamous seed as those from cleistogamous seed.

It was concluded that some control could be exerted over seed type produced. Since in practice the lespedeza seeding rate is rather heavy, in a field planting the plants from chasmogamous seed would probably predominate if the production of cleistogamous seed present was not too high.

The only characteristic of the seed found that could be used for machine separation of seed types was the differential pubescence of the hulls in some seed lots.

10 minutes *2 x 2 slides*

Studies in Caffeine Content in Ilex

A. SHANNON CUMMING, Agnes Scott College
(Introduced by S. L. Doerpinghaus)

Caffeine was discovered in 1920 by Runge, and a short time later by Robiquet and Pelletier, in coffee beans. Because of the widespread use of stumulating beverages containing caffeine (tea in China, Japan, and Korea, in Tibet, and in India; coffee chocolate, and Mate in South America; the "Black Drink" of several North American tribes), both its chemistry and its distribution in the plant kingdom have been much studied. Most recently its presence has been determined by the paper chromatographic method. First discovered by Henry M. Smith in 1872, the presence of caffeine in the leaves of *Ilex vomitoria* has been subsequently studied by various investigators. The application of paper chromatography to the determination of caffeine in *I. vomitoria* and related species is described.

10 minutes *2 x 2 slides*

The Influence of Dietary Fat and Protein Levels Upon the Body Composition of Mice

J. W. LASSITER, A. E. CULLISON and J. L. CARMON,
Animal Husbandry Department, University of Georgia

Three experiments were conducted with weanling mice of the CF strain fed fortified corn-soybean oil meal type diets. In experiment 1, 4 replications of 16 animals each were group fed *ad libitum* for 21 days diets containing 12 or 27 per cent protein with or without 10 per cent added cottonseed oil. Experiment 2 consisted of 3 replications of 16 animals each group fed the same diets *ad libitum* for 23 days. Experiment 3 involved 62 weanling mice paired on the basis of weight, sex and litter and individually fed *ad libitum* for 21 days diets containing 12 or 27 per cent protein with 10 per cent cottonseed oil. Body moisture, fat and nitrogen contents were determined by modified procedures of the AOAC.

In experiment 1 highly significant differences ($P<0.01$) in average daily gain and body moisture occurred. The 12 per cent protein diets caused higher average body fat and lower average body protein contents, but the differences were not statistically significant.

In experiment 2 highly significant differences ($P<0.01$) in body fat and body moisture contents occurred. Significant differences ($P<0.05$) in body protein occurred.

In experiment 3 the 27 per cent protein diets caused higher average daily gains, body protein and body moisture and lower average body fat contents. The differences, however, were not statistically significant.

10 minutes

Viability of Partially Dehydrated Bacteria

T. W. KETHLEY, Engineering Experiment Station,
Georgia Institute of Technology

Large numbers of cells from surface growths of *Serratia marcescens* were harvested into water, with or without additional washing. Weighed quantities of these cell pastes were dehydrated under various conditions to yield water contents as low as 1.0 gm/100 gm solids and as great as 320 gm/100 gm solids. Following dehydration the cells were stored under these various conditions for periods up to 340 hours, and the number of cells capable of colony production determined and reported as viables. From these data the survival potential was calculated and compared with the water content of the cells for the particular condition of storage.

Analysis of the information accumulated revealed a non-linear relationship between survival and water content, there being two distinct maxima and three minima in the plot of water content versus survival. The location and value of these inflections indicate that initial dehydration militates against survival, probably through some concentration effect, but that irreparable damage is not incurred

until dehydration is carried to the point of removal of water from the surface of the protein moities. These findings suggest the value of partial dehydration in determining the role of water in the activity and structural integrity of the systems involved in cellular division.

10 minutes *3¼ x 4 slides*

Effect of X-Rays on Airborne Bacteria

N. W. WALLS, W. T. MARTIN and T. W. KETHLEY
Engineering Experiment Station,
Georgia Institute of Technology

A project has been initiated using airborne bacteria to study the effects of X-radiation on bacterial cells. Experiments are planned in which the water content and/or the oxygen concentration of the air will be varied during irradiation to determine the response of the airborne bacteria to these physical factors. Viability of surviving cell fractions will be determined by plate counts and these will be compared with total cell counts and determinations of representative cell sizes. It is hoped that by these approaches we will be able to distinguish between true death (growth and division stopped), partial inactivation (growth continues but cell divisions inhibited and, therefore, no visible colonies formed), and survival (macro-colony formation).

The radiation source is a 250 Kv therapeutic X-ray machine. *Serratia marcescens* is the test organism of choice.

The special equipment designed and built for use in this study will be discussed. This consists of an atomizer in which a liquid culture of *Serratia* is aerosolized, a prechamber where the aerosol is equilibrated, and a scaled-down model of a rotating cylindrical drum in which the fine particulates of the bacterial aerosol are kept in suspension for several hours by a correct balance between their rate of fallout and centrifugal force. Sampling is done with the use of midget liquid impingers. Since it is anticipated that a one hour running time will be necessary for performance of the radiation experiments, natural biological die-away in the experimental setup for this period of time is being investigated.

10 minutes *3¼ x 4 slides*

Studies on Brucella Phage

JOHN W. FOSTER and ANN BONNELL PEEPLES,
School of Veterinary Medicine,
University of Georgia

Preliminary screening of a group of Brucella isolates suggests that the reported species specificity of this phage may not be absolute. Seven smooth *B. abortus* strains were lysed as expected. Contrary to expectations, 4 of 29 smooth *B. suis* strains were lysed. These strains were culturally *B. suis*. Three *B. melitensis* strains were not lysed. These strains of the Brucella species are now being studied intensively as to cultural, biochemical, and serological activity and phage sensitivity. The results of these studies will be reported on.

10 minutes *2 x 2 slides*

Section I
BIOLOGY

Afternoon Session

A Study of the Effects of Repeated Irradiation on Ciliate Cysts

CHARLOTTE KING, Agnes Scott College
(Introduced by Josephine Bridgman)

The holotrichous ciliate *Tillina magna* was given broken doses of X-irradiation in order to study the effects of repeated exposure to ionizing radiation.

Groups of encysted tillinas were irradiated in a series of thirteen experiments. The single doses of irradiation varied from 25 to 200 kr, with the total accumulated dose reaching as high as 400 kr in several cases. After irradiation, the animals were excysted and isolated in depression slides for daily observation. A count of the daily divisions was made, and at the end of ten days the cultures were abandoned and the average number of total divisions for the ten-day period was calculated.

The results show a lowering of division rate with increased irradiation. The radiation effect is not strictly cumulative, however, for tillinas that received a given dose in one single exposure had as many as 20 divisions more than tillinas that received the same total dose in fractionated exposures. There seems to be no definite evidence of acquired radioresistance; therefore, the difference in divisions is attributed to recovery between doses.

10 minutes *3¼ x 4 slides*

The Effect of the Quality of Blood on the Production of Eggs in Culex quinquefasciatus

HELEN B. JORDAN, Georgia State College

In maintaining a colony of *Culex quinquefasciatus*, various animals on hand in the laboratory at the time furnished blood for the females. Since there were noticeable variations in the size of egg rafts, depending on the blood source, some simple feeding experiments were carried out to measure the effect of the quality of various bloods on the production of eggs in this species, and to study its natural feeding habits.

After feeding on lizards (*Sceloporus undulatus* and *Anolis carolinensis*) and chickens (*Gallus gallus*), *C. quinquefasciatus* produced significantly more eggs than they did after feeding on snakes (*Heterodon platyrhinos*, *Lampropeltis getulus*, and a boa), bats (*Myotis grisescens*), and opossum (*Didelphis marsupialis*). Following a blood meal from *Myotis*, they produced an average of 90 eggs per raft. When these same mosquitoes were allowed to re-feed on *Sceloporus*, about two weeks later, they produced 133 eggs per raft. Similarly, mosquitoes previously fed on *Didelphis* with an average of 79 eggs per raft, were allowed to re-feed on *Sceloporus*, and they produced 117 eggs per raft from the second blood meal. The number of eggs per raft resulting from snake blood was 89, while that from lizard blood was 132. Chicken blood produced more eggs (141 per raft) than any of the other bloods tested. All test mosquitoes fed to repletion and were kept at 28° C.

Some blood preferences were noted.

8 minutes *3¼ x 4 slides*

Research Activities of the United States Forest Service in Georgia

W. A. CAMPBELL, Research Center Leader, Macon Research Center, U. S. Forest Service, Macon

20 minutes

Little Fleas have Lesser Fleas:—Bacteriophage

W. B. REDMOND
Veterans Administration Hospital, Atlanta

Viruses may not be the ultimate in size reduction as far as living organisms are concerned, but at the present time they are generally conceded to be the smallest entities that may be referred to as living organisms. Their lack of metabolic reactions and their mode of reproduction cast doubts as to the 'living' status of some viruses and particularly bacterial viruses, or bacteriophage.

The temperate (lysogenic) bacteriophages have exemplified some of the most interesting phenomena in this field. A brief discussion on lysogeny will include lysogenic conversion, transduction, zygotic induction, and the implications of defec-

tive lysogenics. Experiments have indicated that the tubercle bacillus may be lysogenic.

Recently we have isolated from soil approximately 30 phages which lyse acid-fast bacilli. These are active on ATCC .607 and on other saprophytic strains. They vary both as to plaque morphology and host range. *Mycobacterium smegmatis* and *M. fortuitum* are lysed by some strains but not by others. None lysed *M. phlei* or the pathogenic *M. tuberculosis*. However, by using the soil enrichment technique phage strains have been adapted to lyse these last two species. The phage used for the enrichment lysed 607 but not phlei or tubercle bacilli. After adaptation for about 3 weeks two phage strains were isolated; one (DS6) lysed the tubercle bacillus, the other (DS2) lysed phlei. The DS6 strain has been tested on 200 or more strains of mycobacteria including 100 pathagenic, 35 saprophytic and 65 atypical strains. Only the pathogenic strains have been lysed. It is suggested that this strain may be of service in phage typing of the mycobacteria. Attempts are being made to produce other type specific strains by adaptation to specific strains of bacteria.

Catalytic Action of Enzymes in Plant Metabolism

A. A. NIKITIN, Tennessee Corporation

NO ABSTRACT

SECTION II

FRIDAY, APRIL 22, 1960—9:00 A.M.

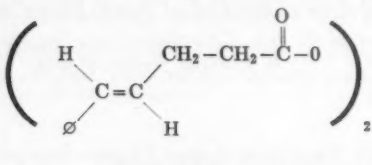
Room 230, New Chemistry Building

Dr. J. F. Vincent, Presiding

The Kinetics of the Thermal Decomposition of trans-bis (δ - Benzilidene-n-butyryl) Peroxide in Carbon Tetrachloride and other Solvents

ROBERT C. LAMB, University of Georgia

The rate of decomposition of trans-bis (δ—Benzilidene-n-butyryl) peroxide



in carbon tetrachloride is a great deal faster than the rate of decomposition of its saturated analog, bis(δ-phenyl-n-valeryl) peroxide. The kinetics are not first order, even at initial concentrations as low as 0.025 M. The data fit a first plus three halves order differential expression with good accuracy (at 65° and 70°). One can calculate that, at 70° and an initial concentration of 0.025M, some 75% of the peroxide is decomposed by the higher-order, free radical chain mechanism. The values of the first and three-halves order rate constants and their activation energies will be presented. The kinetics of decomposition of this diacyl peroxide in toluene and other solvents will also be discussed.

20 minutes *3¼ x 4 slides*

Kinetics of the Reaction of Copper with Ferric Chloride Solution

DONALD E. SAIRE, C. TURNER LEWIS, and W. H. BURROWS
Georgia Institute of Technology

Copper metal used in these studies was irradiated in the graphite pile at Oak Ridge, producing radioactive Cu-64. Samples were exposed to a stream of ferric chloride at various temperatures, and the rates of reaction were measured in terms of the build-up in radioactivity in the ferric chloride solution. Concentrations of ferric chloride were varied from 0.5 to 3.5 molar and temperatures from 25 to 45° C. Results indicate a diffusion controlled reaction with parabolic dependence upon concentration of ferric chloride.

This research was supported by the U. S. Atomic Energy Commission.

15 minutes *3¼ x 4 slides*

The Chattahoochee River below Buford Dam

ROBERT S. INGOLS and ROBERT D. WILROY
Georgia Institute of Technoligy, and Wiedeman and Singleton

The power impoundment created by the Buford Dam has made many changes in water quality in the Chattahoochee River below the dam. These changes in water quality include some factors of improvements and some of deterioration.

The water is much clearer from the removal of the clay and the mud of the surface run off during rains. The average daily flow during dry weather has been increased although the minimum flow or discharge at some times of the day or week now equals the natural minimum.

During the summer the water has been 15 degrees cooler than in past years. The water is much lower in dissolved oxygen, has a lower pH at the discharge. A few miles downstream from the dam, the dissolved oxygen has recovered but the temperature remains low. Because the river is clear and shallow during the low flow periods (from the low night power discharge), many algae (In the Spring: Cladophora, major, Spirogyra, minor; in the Fall: Stigeoclonium Lubricum) are found growing on the bottom of the river a few miles downstream.

Data on the rate of recovery in dissolved oxygen and temperature will be presented and discussed briefly.

30 minutes *2 x 2 slides*

The Application of Dyestuffs to Textile Fibers

WILLIAM POSTMAN, Georgia Institute of Technology

After a brief introduction in which the origins of textile dyeing are indicated, this paper discusses the dyeing process in general; then proceeds to describe the role of salt in the application of direct dyes to cellulosic fibers, acid dyes to wool, and in "naphthol" dyeing. The role of the dispersing agent in the application of disperse dyes to cellulose acetate is described. The methods used for dyeing the difficultly dyeable synthetic fibers are then outlined; and in conclusion, the new chemically reactive dyestuffs are mentioned.

20 minutes

SECTION III

EARTH SCIENCES

FRIDAY, APRIL 22, 1960—9:00 A.M.

Room 2B New Math, Geography and Geology Building

H. E. Cofer, Presiding

The preCretaceous topography of the Georgia Coastal Plain

JOHN E. HUSTED and H. W. STRALEY, III
Georgia Institute of Technology

Recent work has made it apparent that the eroded rocks underlying the Atlantic coastal plain do not form a monotonously flat and uniform surface sloping gently toward the sea. Indeed, there is no theoretical reason why anyone should have assumed that it did, except for purposes of simplification. Other similar erosion surfaces, such as that of Angola or Brazil, have demonstratable topographic features of significant magnitude.

A number of wells have been drilled to the basement at various places on the coastal plain of Georgia. The logs of these wells are not perfect, but most of them are sufficeintly well done to permit determination of whatever preCretaceous surface may have existed. Although the preponderant proportion of the well data is from the Fall Zone area, the writers have thought it desirable to present a map showing a first approximation to the top of the preCretaceous erosion surface underlying the present Mesozoic and Cenozoic sediments.

10 minutes *35 mm slides*

Geology and Ground-water Resources of Lee and Sumter Counties, Southwest Georgia

VAUX OWEN, JR., U. S. Geological Survey, Albany

Lee and Sumter Counties are underlain by more than 5,000 feet of Lower Cretaceous, Upper Cretaceous, and Tertiary sedimentary rocks. Water is produced from wells constructed in rocks of the Upper Cretaceous series and Tertiary system from depths ranging from 60 to 1,000 feet. The Upper Cretaceous series includes the Tuscaloosa formation and overlying undifferentiated Upper Cretaceous deposits. The Tertiary system includes, in ascending order, the Clayton formation and undifferentiated deposits of the Midway group, the Tuscahoma sand of the Wilcox group, the Tallahatta and Lisbon formations of the Claiborne group, the Ocala limestone of the Jackson group, the Flint River formation, and undifferentiated residuum.

The gross structure of the area is the regional dip, which is generally to the southeast. The rate of dip increases with depth and ranges from about 12 feet per mile on top of the Ocala limestone to about 22 feet per mile on top of the Upper Cretaceous series. The regional structure is modified in a belt which runs in a general southeast-northwest direction across Sumter County. Along this belt the southeastward dip of most formations is greater than elsewhere. The structural belt also appears to have influenced depositional conditions, and it apparently marks the updip limit of the Lisbon formation and the Ocala limestone as well as a coquina bed which occurs at the top of the Tallahatta formation. The regional structure is modified also by the Andersonville fault in northeastern Sumter County and by similar faults in western Sumter County. The faults have east-west trends and are downthrown on the north.

The principal aquifers are the undifferentiated Upper Cretaceous deposits, the Clayton formation, the undifferentiated Midway deposits, the Tallahatta formation,

and the Ocala limestone. The Tuscabosa formation is an aquifer but has not been drilled because of its depth; the Tuscahoma sand, Lisbon formation, and undifferentiated residuum serve mainly as confining beds because of their relative impermeability.

Clastic Dikes in Stewart County, Georgia

HOWARD ROSS CRAMER

New road cuts on the Lumpkin-Providence Canyon road have revealed several vertical kaolin dikes in the Providence formation (Upper Cretaceous). Many are tiny, but some are over six feet wide and over 20 feet long from the top of the cut to where they disappear below the cut. Various explanations are considered, among them being fault fillings, vertically tilted bedding, original deposition in fissures, filled earthquake-formed fractures, squeeze-ups from below, slumping, and ground water deposition similar to that which has probably deposited the overlying Clayton iron ores. None seems adequate, although field work is continuing.

10 minutes *slides*

Source and Quality of Ground-Water in Southwestern Georgia

ROBERT L. WAIT
U. S. Geological Survey, Brunswick

Ground water in southwestern Georgia is obtained from rocks ranging in age from Late Cretaceous to Miocene. The main aquifers in the Late Cretaceous are the Providence sand, the Cusseta sand, a sand near the base of the Eutaw formation, and the Tuscaloosa formation. The limestone of the Clayton formation is the main aquifer in the Paleocene series. A sand and sandy coquina of the Tallahatta formation (middle Eocene) is the most important aquifer in the Claiborne group; it furnishes water to municipal wells at Albany, Cordele, and Vienna. The Ocala limestone (Upper Eocene) of the Jackson group is present throughout most of the Dougherty plain and is the source of much water for domestic, municipal, industrial, and irrigation supplies. The Tifton upland is underlain by the Ocala limestone, the Suwannee limestone of Oligocene age, and the Tampa limestone of Miocene age. These three formations are referred to as the "principal artesian aquifer" in that area; the aquifer furnishes water in about two-thirds of the Coastal Plain region.

The water from the aquifers in the Upper Cretaceous rocks is generally of the sodium bicarbonate type, quite soft, and slightly alkaline. Connate water—water which was entrapped at the time the rocks were deposited and is usually high in sodium and chloride—is present at depth in the Upper Cretaceous rocks in downdip areas.

The Tertiary rocks produce slightly alkaline water of the calcium bicarbonate type, ranging from moderately hard to hard. In the area of the Withlacoochee anticline at Thomasville, water high in calcium and sulfate was obtained from the Claiborne group. At Valdosta water high in magnesium and sulfate was reported from a city well. These areas of poor-quality water probably are influenced by geologic structure.

A Mineralogical Evaluation of the Cretaceous and Eocene Formations of Crawford County, Georgia

ALFRED T. NAVARRE
Georgia Institute of Technology

This study embraces the environment of deposition and changes in strand-line conditions which are responsible for the difference among varied formations starting with the Tuscaloosa and ending with post-Ocala erosion. Attempts will, also, be made to explain the presence of kaolin balls in the Atlanta Sand pits in the Gaillard

community, as well as banded lenses of varicolored clay and kaolin beds, situated between stream cross-bedded sand lenses.

10 minutes *35 mm slides*

Are the Cherokees an Indigenous Southeastern Group?

A. R. KELLY
University of Georgia

Ever since Rafinesque gave his version of the Delaware Indian account of Cherokee origins in 1836, and James Mooney accepted this view in his *Myths of the Cherokee*, subsequent southeastern ethno-history has favored a northern origin and migration of the Cherokee. John R. Swanton, in his *History of the Creeks* and in his *Southeastern Tribes*, has recapitulated and seems to favor the prevailing theory. Until recently, in connection with extensive river basin salvage, plus archeology in north and northeast Georgia, little opportunity has been afforded for archeology to check against the ethno-history of the region by exploring stratified situations where authentic historic Cherokee settlements can be traced backward into proto-historic and pre-historic levels.

Such an opportunity has been afforded in recent years in the Hartwell River Basin where the Historic Cherokee landmarks of Tugalo, Estatoe and Chauga are currently being analyzed. Also, other sites in north Georgia give parallel evidence.

Both in north and northeast Georgia, the complex stratigraphic sequence indicates that the earlier mound history and earlier village history, in some instances, reflect a composite or blended culture, attributed in local southeastern archeology, to the Etowah tradition and to another defined as "Savannah". Savannah was first defined by Joseph R. Caldwell and his associates in the key work done at the Irene Mound at Savannah, Georgia.

It appears that an earlier Complicated Stamp tradition, known locally as "Savannah" and as "Wilbanks" in north Georgia, is now perceived to be part of an archeological continuum which ultimately modifies into a ceramic assemblage called subareally in north and northeast Georgia, Early or Transitional Lamar. These Lamar components, in turn, continue unbroken into historic Cherokee in the situations summarized in this paper.

The Future of Earth Science in the College

H. W. STRALEY, III
Georgia Institute of Technology

Many factors have changed the college of a score of years ago. Not the least have been urbanization, making earth-science instruction doubly difficult, and the extended use of basic science, which bids fair to make both faculty and subject obsolete. Conditions of employment of graduates, likewise, have been revolutionized. The effect of both may have reduced the traditional curriculum, even as modified during the last two decades, to something verging on absurdity.

The writer proposes a new curriculum including: the secondary foundation, the college requirements, and the graduate superstructure.

15 minutes *35 mm slides*

Section III

EARTH SCIENCES

Afternoon Session

Mineralization of Lower Mississippian Chert Nodules Collected in Northwest Georgia

A. E. COKER
Emory University

In Floyd County, near Rome, Georgia, in the lower Mississippian, are found ellipsoidal mineralized chert nodules. Portions of the nodules are mineralized by marcasite, pyrite and calcite. In the samples studied it is found that marcasite is the most abundant iron sulfide, being confined primarily to the central portions of the mineralized zones with pyrite forming the outer boundaries. This zonation is probably due to a Ph gradient which existed in the nodules before silicification. The mineralization appears epigentic in relation to the formation of the nodules.

10 minutes

A Microscopic Study of the Limestones of the Fort Payne Formation

DAVID P. DURHAM
Emory University

The limestones of the lower Fort Payne formation in Big Wills Valley near Fort Payne, Alabama, range from pure light-gray limestone to highly silicious dark-gray limestone. Chert stringers are common.

Microscopic examination reveals secondary drusy pyrite usually parallel to the bedding. Secondary quartz is commonly found in association with the pyrite. Pure white calcite occurs in very small, randomly oriented, unconnected, tube-like cavities and as micro-fracture fillings. Flocculent iron oxide forms dispersed indistinct bands parallel to the bedding.

10 minutes

Geology and Ground-Water Resources of Dade County, Georgia

MACK G. CROFT
U. S. Geological Survey, Atlanta

Mountainous Dade County is in the area of Paleozoic rocks in the northwest corner of the State of Georgia. The county is at the edge of the Cumberland Plateau and includes 165 square miles. Land-surface altitude ranges from 700 to 2,000 feet above sea level. The area receives about 53 inches of precipitation annually, the greater part of which occurs during the winter and spring months. Agriculture is the principal occupation.

The Knox dolomite of Ordovician and Cambrian age is the oldest formation in the county. The Ordovician system also includes the Chickamauga limestone and the Sequatchie formation (limestone and shale). The Red Mountain formation of Silurian age consists of limestone, shale, and sandstone, and is overlain by the Chattanooga shale of Devonian and Mississippian age. The Mississippian system consists of the Fort Payne chert, St. Louis limestone, St. Genevieve linestome, Gasper formation, Golconda formation, Hartselle sandstone, Bangor limestone, and Pennington shale. The Pennsylvanian system consists of the Gizzard and Sewanee members of the Lookout sandstone, the Whitwell shale, the Bonair sandstone, the Vandever shale, and the Rockcastle sandstone.

The rocks throughout all but the northwestern part of the county are broadly folded into the Lookout Valley and Wills Creek anticlines and the Lookout Mountain syncline. The east flank of the Lookout Valley anticline is thrust faulted.

Ground water has been developed primarily for domestic and farm use. Wells of highest yield are in the carbonate rocks in which extensive solution channels occur along bedding planes, fractures, and other openings. The water is hard. Ground water from the Fort Payne chert is of excellent chemical quality and suitable for municipal and industrial use.

A Contribution to the Petrography of the Silurian Iron Ores of Northwest Georgia

RICHARD C. FOUNTAIN
Emory University

This investigation consists of descriptions of primary and secondary depositional features as observed in polished and thin sections under the binocular and petrographic microscopes.

The matrix of the ore bed varies greatly in percentage of minerals present, but very slightly mineralologically. The predominant constituents are hematite, calcite and quartz. The hemitite occurs as matrix material, replacing some of the fossils present as rounded grains, some of which have centers of calcite. The calcite seems to be of two or more generations comprising a part of the matrix as well as being present in the form of fossils. Quartz is found in subrounded grains and as secondary interstitial material. The various percentages of these respective minerals is not consistent in any one location.

A secondary origin for these ores is supported by the evidence gathered in this investigation.

12 minutes

The Blue Ridge Fault Zone and the Distribution of Southern Appalachian Earthquakes

JOHN E. HUSTED and H. W. STRALEY, III
Georgia Institute of Technology

The Blue Ridge, bordering the Piedmont province on the west, is a prominent physiographic feature from Pennsylvania to Georgia, U. S. A. White has attributed its southeastern escarpment to faulting. Is it purely fortuitous that a recent earthquake, centering near Ashville, North Carolina, lies almost on the trace of this hypothicated fault. It would appear that plotting the epicenters of southern Appalachian earth quakes might throw some light upon the matter, especially if depths to foci were known. Accordingly, the writers have attempted to present such a correlation.

15 minutes *35 m.m.*

Status of Lithologic Mapping in Crystalline Rocks of Georgia

VERNON J. HURST
Georgia Geological Survey

About 34% of the State, or 19,780 square miles, is underlain by crystalline rocks. Lithologic maps—those showing distribution of rock types rather than formations—have been prepared for about 8% of this area.

The mapping has outlined two major stratigraphic sequences: (1) a thick metagraywacke-mica schist unit (the Ocoee Series) overlain by black slate, metasubgraywacke, marble, chloritesericite schist and quartzite (the Murphy Series); and (2) at least 1500 feet of metavolcanics (metamorphosed lavas and pyroclastics) interlayered with and overlain by several hundred feet of mica schist, garnet-mica.

schist, quartzite, and mica schist. The first sequence includes nearly all the crystalline rocks west of a line passing through Buchanan, Allatoona, the Lumpkin County-Fannin County boundary, and on to the northeast. The second sequence is east of the first, and extends at least as far as the Braverd belt. Detailed studies of the Brevard belt are now being made.

10 minutes *slides*

Strontium in the Dolomite-Marble of the Brevard Belt

VERNON J. HURST and WILLIS A. HOLLAND, JR.
Department of Mines, Mining and Geology

The dolomite-marble of this belt has an average Sr content of 0.0067% and an average Sr/Ca ratio of 0.0003% which is much less than that of the average carbonate rock.

The low Sr content might be due to:
(1) Old age (Cambrian?, preCambrian?)
(2) Origin as a chemical precipitate
(3) Dolomitization.

Georgia Palynology and Petrology—A Preliminary Report

J. G. LESTER, Emory University

An effort is being made to apply the techniques of palynology to some of the metasediments of the Georgia Piedmont in an attempt to gain some idea of their relative ages.

Samples taken from the Perote formation of the Coastal Plain were studied in order to perfect the separation procedure and to set up certain statistical criteria.

10 minutes

Determination of Rate of Diffusion and Activation Energy of Helium through Polycrystalline and Single Crystal Alumina

WILLIAM B. CAMPBELL, JR.
Georgia Institute of Technology

This paper deals with experimental apparatus necessary to measure flow rates of gases to an order of magnitude of 10^{-11} cc/sec. and the values obtained from helium diffusion through a ceramic body and single crystal sapphire. From determined activation energies the mechanism of diffusion was predicted for the materials.

The purpose of this work was to investigate, over a high temperature range, the diffusion mechanism by which an inert gas passes through alumina and thereby makes a contribution to the basic knowledge of gas diffusion through solids.

20 minutes *3¼ x 4 slides*

A Turbidity Meter for Field Use

WILLARD H. GRANT, Emory University

The paper describes the construction, operation and possible uses of a field turbidity meter.

The meter can be calibrated to show the amount of sediment in stream waters. It also can be used in field determination of calcium in ground water.

Geologic Control of Movement of Ground-Water in Crystalline Rocks in Dawson County, Georgia

CHARLES W. SEVER, JR., U. S. Geological Survey, Atlanta

Dawson County is an area of about 213 square miles in north-central Georgia. It is underlain by many kinds of rocks: interbedded biotite gneiss and garnet-biotite schist having graywacke affinities; interlayered sillimanite-quartz schist, sillimanite-biotite gneiss, and biotite-amphibole gneiss; crossbedded kyanite-quartz-sericite gneiss and schist; interbedded siltstone and conglomerate; and amphibolite.

Field observations show that water infiltrating from precipitation moves vertically downward through the soil zones, but upon entering the zone of decomposed rock (saprolite) the direction of movement changes and water moves parallel to the foliation until it encounters an impermeable hard rock layer. Because not all the water can flow into the few openings in the hard rock, some of it becomes perched on the hard rock; and as the water table builds up, lateral movement occurs along sheeting joints and bedding and foliation planes.

Owing to differential weathering of the rocks along joints, the same amount of water does not move along each joint; instead, large quantities may move along a few isolated joints. Weathering increases with the linear extent of the joint. Although some joints are not open, adjacent to them are porous zones which are of consistent width with increasing depth. Such zones probably are water bearing to depths greater than 500 feet.

Pumping and infiltration tests made at GNAL (Georgia Nuclear Aircraft Laboratory) indicate that the greater volume of water moves along the foliation planes.

Streamflow data collected at GNAL shows that locally the direction of streamflow is controlled by bedding and jointing. Streamflow derived from ground water is greatest in streams flowing normal to the foliation, and the greatest discharge occurs on dip slopes.

Section IV

PHYSICS, MATHEMATICS AND ENGINEERING

FRIDAY, APRIL 22, 1960—9:00 A.M.

Physics Building Auditorium

R. H. Rohrer, Presiding

Epitaxial Growth of Thin Metal Films

W. E. WOOLF, A. P. YOUMANS, JR., and R. B. BELSER,
Engineering Experiment Station, Georgia Institute of Technology

A brief introduction to the subject of epitaxial growth of metal films on non-metallic substrates will be presented. Experimental procedures used in preparing copper films on sodium chloride cleavage surfaces will be described and preliminary results will be discussed.

10 minutes

Orientations Developed in Vapor Deposited Thin Metal Films

DOROTHY A. BRINE and R. A. YOUNG,
Engineering Experiment Station, Georgia Institute of Technology

Thin films of Cu, Au and Ag were evaporated onto heated rock salt [100] cleavage faces and examined by x-ray and transmission electron diffraction techniques. The types of orientations observed in these studies agree with results previously reported

by Pashley (Adv. in Phys., 5; 173. 1956). A mechanism relating the orientation characteristics at various substrate temperatures is presented. Films deposited at room temperature exhibit no preferred orientation about a frequently occuring [111] fiber axis. At increased temperatures a range is encountered within which a [111] fiber axis normal to the substrate surface is developed such that the crystallite orientations in the metal film are restricted to the 12 possible positions, equally probable, in which some [110] type direction in the metal crystallites is parallel to a [110] direction in the face of the NaCl substrate crystal. This work was supported in part by Air Force Contract No. AF 33(616)-6379, Wright Air Development Center.

10 minutes *3¼ x 4 slides*

A Study of Thin Metal Film Thermocouples

J. CONRAD MEADERS, Engineering Experiment Station
Georgia Institute of Technology

Cleaned glass microscope slides were used as substrates upon which silver, gold, platinum, palladium and iron were sputtered in pairs to form thin-film thermocouples. The thermal e.m.f.'s of the combinations Au-Ag, Au-Pt, Au-Pd and Au-fe were measured in the temperature range 25°C to 260°C. Thermal e.m.f.'s of higher than 0.12 millivolts were obtained from the Au-Ag and Au-Pt combinations. The Au-Pd combination produced a thermal e.m.f. of 1.6 millivolts maximum. Data obtained fell on curves which were linear in the temperature range.

A system was devised for testing thin metal film thermocouples in a vacuum. The cold junction was maintained at 0°C by the use of a water-ice mixture, while the hot junction was maintained at various temperatures by a heating box. The temperatures were in the range 25°C to 300°C and were monitored with a chromel-alumel thermocouple. Data obtained with this apparatus will be discussed.

15 minutes *3¼ x 4 slides*

The Thermal Coefficient of Expansion of AgCl Between 100°K and 300°K

ROBERT M. NICKLOW and R. A. YOUNG,
Engineering Experiment Station, Georgia Institute of Technology

The thermal coefficient of expansion of AgCl has been measured from 100°K to 300°K as a function of crystallographic direction by means of x-ray diffraction from single crystals. The methods used to make the measurements and to vary the sample temperature are described. The results are discussed in relation to the theoretically expected temperature and (lack of) directional dependence of this coefficient. This work was supported by the office of Naval Research.

10 minutes *3¼ x 4 slides*

An Automatic Recording System for the Study of X-ray Dosages Used in Routine Clinical Fluoroscopy

WILLIAM B. MILLER, JR., Department of Radiology,
Emory University

The determination of absorbed radiation dose in the human body during fluoroscopic examinations requires a complete record of several variables occuring in the procedure. Specifically, a continous record of x-ray beam area, beam position, and exposure time must be made. A system to perform this function is here described.

Four transducer elements providing a voltage analogue representing mechanical position are attached to a conventional x-ray fluoroscope. Two of these define the beam area by denoting beam diaphragm positions; and two indicate x-ray beam position by denoting tube carriage co-ordinates. The exposure time is derived from

the voltage signal produced when the x-ray machine is turned on, and the duration of this voltage. The voltages from these five variables are then sampled at a fixed rate from a well controlled time base so that each is recorded at a known time. After sampling the voltages are converted from analogue to digital form and recorded on punched tape.

Hence, a complete record of beam position, beam area, and exposure time is made. Data can be taken directly from the tape for calculation of unknown quantities; or the tape may be used to control an automatic servo-operated fluoroscopic simulator for direct dose measurements. This work is supported by the United States Public Health Service, National Institutes of Health.

15 minutes *2 x 2 slides*

Preparation of a Small Co^{60} Test Score

HENRY J. FULLBRIGHT, III
Departments of Physics and Radiology, Emory University

At Emory several sources of gamma radiation are available. We have two large sources, one of 1000 Curies of Co^{60} and the other of 200 Curies of Co^{60}. Very small sources, in the millicurie and microcurie range, of many materials are also available. A source of medium-energy gamma rays in the one or two curie range is sometimes desirable. The design and construction of a two curie Co^{60} source will be discussed, involving design criteria and experimental results. A radiation survey of the completed installation will be presented. The utility of this source as a calibration standard will be discussed.

10 minutes *2 x 2 slides*

Absorption Characteristics of Soil for Co^{60} Gamma-Radiation

RALPH E. SMITH
(Introduced by E. H. Dixon, Sr.)
Department of Physics and Astronomy, University of Georgia

Experimental information about the absorption characteristics of soil for Co-60 gamma-rays was needed in a study at the University of Georgia that sought to measure the build-up in the counting rate under field conditions. A collomated beam arrangement was used to measure the mass absorption coefficient for a range of soil samples whose moisture content varied from air dry to 30% by weight. The computational method so often used for determining this constant for mixtures and compounds does not appear to hold for soils, and the mass absorption coefficient does not change with the addition of water to the sample as the computational method indicates. The average value of the mass absorption coefficient for twenty four differing samples of soil was .0584 cm^2/gram with a standard deviation of .004 cm^2/-gram. The constancy of the mass absorption coefficient of soil indicates that the build up in counting rate under field conditions as compared to narrow beam conditions may be accurately measured and very useful in relating soil density to actual counting rate under field conditions.

20 minutes

Unscrambling of Continuous X-ray Spectra

THOMAS R. FEWELL, Department of Radiology
Emory University

The relative energy distribution of x-rays (primary or secondary) must be known in order to accurately convert from ionization dose (roentgens) to absorbed dose (rads). We have employed a scintillation spectrometer with a NaI(Te) crystal detector to measure the primary and secondary x-ray spectra from tissue equivalent material. A method for converting the pulse height distribution spectrum of the

spectrometer to the actual energy spectrum of the incident photons will be described. The corrections for Gaussian resolution and Iodine K x-ray will be supplemented by a brief discussion of the equipment and its calibration. This work is supported by grant from the United States Public Health Service.

20 minutes *2 x 2 slides*

The Emory Standard Ionization Chamber

BRUCE L. BLANKS, Department of Radiology
Emory University

The measurement of x-ray exposure dose is normally accomplished with the use of portable condenser-type ionization chambers. These chambers must be periodically calibrated against some standard if an accuracy of greater than 95% is desired. The most satisfactory standard for the measurement of x-ray exposure dose is the parallel-plate, free-air ionization chamber. By careful measurement of critical physical parameters, attention to certain structural details, and accurate measurement of ionization current, errors in the final measurement should be less than $\pm$ 0.5%. The design, construction, and estimation of errors of the Emory Standard Ionization Chamber are presented.

15 minutes *2 x 2 slides*

Section VI

PHILOSOPHY AND HISTORY OF SCIENCE

Room 232, New Chemistry Building

FRIDAY, APRIL 22, 1960

Morning Session

James A. Gould, Presiding

Apocalypitium and the Scientific Development in the 17th Century

LEROY LOEMKER, Emory University

Thesis: The general prevalence of millinarican thought in the century was a significant motive in the growth of the academies and the promotion of science, as well as a factor in the development of the modern conception of progress.

30 minutes

The Methodology and Ethics of Economic Liberalism

JON JOHNSTON, Georgia State College

Discussion of liberal economics from Adam Smith to J. M. Kaynes with regard to the value basis and methodological assumptions.

30 minutes

ALL SECTIONS

GENERAL

FRIDAY, APRIL 22, 1960—3:30 P.M.

Auditorium, New Chemistry Building

J. C. Simms, Presiding

Wind Velocities from Artificial Clouds at Altitudes in the 100-200 km Region

HOWARD D. EDWARDS and JOHN L. BROWN,
Engineering Experiment Station, Georgia Institute of Technology

Wind velocity has been determined in the altitude region between 100 km and 200 km from a triangulation study of the drift of artificial clouds created at these altitudes by chemicals carried aloft in rockets. Speeds up to 127 m/sec. have been observed and with bearings ranging from 35° E of N to 335° E of N. High wind shear regions have been found in the vicinity of 101, 105, and 113 km.

20 minutes

Spectral Distributions from Artificial Clouds at Altitudes in the 100-200 km Region

JOHN L. BROWN and HOWARD D. EDWARDS,
Engineering Experiment Station, Georgia Institute of Technology

Spectral emission in the visual region from chemicals released in the upper atmosphere by high-altitute rockets has been studied by means of photometry through narrow-band interference filters. Indications have been obtained of the excitation of the first negative system of N_2^+ at 4238 Å and 4278 Å as well as the No-Beta band at 3801 Å. Emission strengths were of the same order of magnitude as the resonance radiation.

20 minutes

A Theory of Animal Music

CHARLES HARTSHORNE, Department of Philosophy,
Emory University

Various animals besides man have the capacity to "sing", that is, to produce sounds which in some degree have the traits distinguishing music from mere noises, or mere cries, squeaks, grunts, or growls. This capacity is found chiefly in insects, batrachians, and birds. These all share in most, and those with well-developed musical capacity share in all, of the following characteristics: they are visually inconspicuous, being small, protectively colored, hidden in vegetation or dim light; they make but slight use of smell; they have unusually rapid means of escape if singing attracts an enemy; they can obtain their food without maintaining silence; they need to attract and keep in communication with mates at a distance; they also need to warn territorial trespassers, especially rival males. These factors maximize the importance and utility of auditory signals.

Since birds in general have all the above features except, in some cases, inconspicuousness and territorial habits, the development of musical ability in species of birds should, according to the theory, vary chiefly with their visual imperceptibility and territoriality. This correlation in fact obtains in high degree.

Though song develops according to the utility of auditory communication, song may also be enjoyed aesthetically. For selective pressure may favor individuals whose interest in sound-production of a distinctive, musical kind causes them to act in a manner fitting the needs of the species.

10 minutes

A Growth Stimulating Effect of Gravity

BETTY F. EDWARDS and STEPHEN W. GRAY
Georgia State College and Emory University

Wheat seedlings do physical work in growing upward. The work required may be increased 1) by placing weights upon the seedlings, or 2) by increasing the force of gravity acting upon them in a centrifuge. When the same amount of extra load is imposed upon the seedlings by the two methods, growth of the weighted plants is depressed and growth of the centrifuged plants is stimulated.

Plants bearing 200 mg. weights from 48 to 96 hours after germination grew an average of 9.2% less than did control plants at 96 hours; while those placed under an equivalent load in the centrifuge grew 18.6% taller than did control seedlings. The growth response appeared about 24 hours after the centrifugal force had been applied. Growth at a constant 50 x gravity over the same period of time, although requiring about 5 times as much work as growing with a 200 mg. weight, resulted in plants only 2.8% shorter than control plants. At this force, the stimulation due to gravity is almost exactly cancelled out by the inhibition due to the increased weight of the tissues.

It has been shown that the weight of overlying structure does not constitute the stimulus to increased growth, as might have been postulated from earlier experiments. An effect of gravity directly on the cytoplasm of the growing cells is indicated even though no stratification of cell contents has been observed at forces below 500 x gravity.

10 minutes *3¼ x 4 slides*

SYMPOSIUM

FRIDAY, APRIL 22, 1960—8:00 P.M.

Auditorium, New Chemistry Building

Topic:— Science in Georgia, —1960

A Review of the Status of Science in Georgia as of 1960

A recapitulation of the program developed in Georgia to meet the educational needs of students, teachers and investigators in preparation for the world of the future dominated by science.

Participants:

1. The science curriculum K-14.
   W. B. Baker, Director of Curriculum Conference.
2. Reception and implementation of the state wide curriculum.
   Victor Bullock, Science Consultant, Georgia State Department of Education.
3. In Service training program for science teachers.
   W. H. Jones, Director, Emory Summer School.
4. Special program for high school students in science.
   J. G. Lester, Professor of Geology, Emory University.
5. Some specific research programs in applied science.
   Vernon J. Hurst, State Department of Mines, Mining and Geology.
6. Specific program of the Georgia Junior Academy of Science.
   Mrs. Lucille Burnett, Director.

VIVIAN